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V. DEWOLF

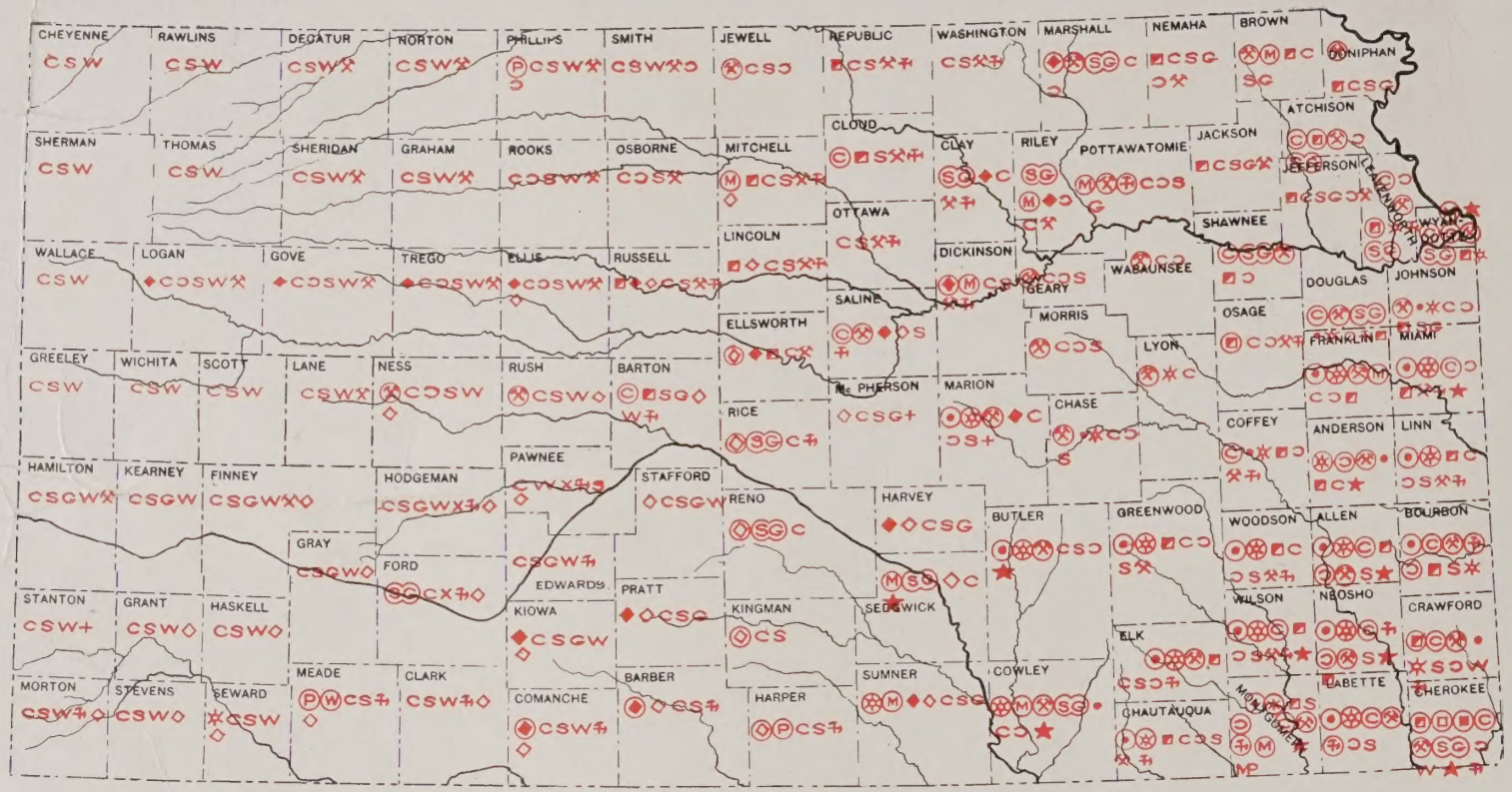
STATE GEOLOGICAL SURVEY

A Central Kansas Oil Field

THE MINERAL RESOURCES OF KANSAS

By RAYMOND C. MOORE, STATE GEOLOGIST

MINERAL RESOURCES BY COUNTIES



ANNUAL MINERAL PRODUCTION IN KANSAS

● Petroleum	35,446,000 bbls.	$115,000,000	◆ Gypsum	54,958 bbls.	343,000
◪ Coal	7,561,947 tons	22,028,142	S Sand and G Gravel	761,110 tons	264,073
✳ Natural Gas	27,824,641 M. cu.ft.	6,640,781	M Mineral Water	403,862 gals.	75,353
⊃ Cement	3,083,000 bbls.	4,825,000	Natural Gas Gasoline	5,500,000 gals.	800,000
◇ Salt	873,576 bbls.	4,497,247	MP Mineral Paints and Pumice		
■ Zinc	20,249 tons	4,130,796	Asphalt, sulphuric acid, lime, etc.		2,285,603
C Clays		2,064,520	W Artesian or other important Underground water	Total	$164,035,997
⚒ Limestone and ⚒ Sandstone		561,382			
□ Lead	3,025 tons	520,300	★ Refineries		

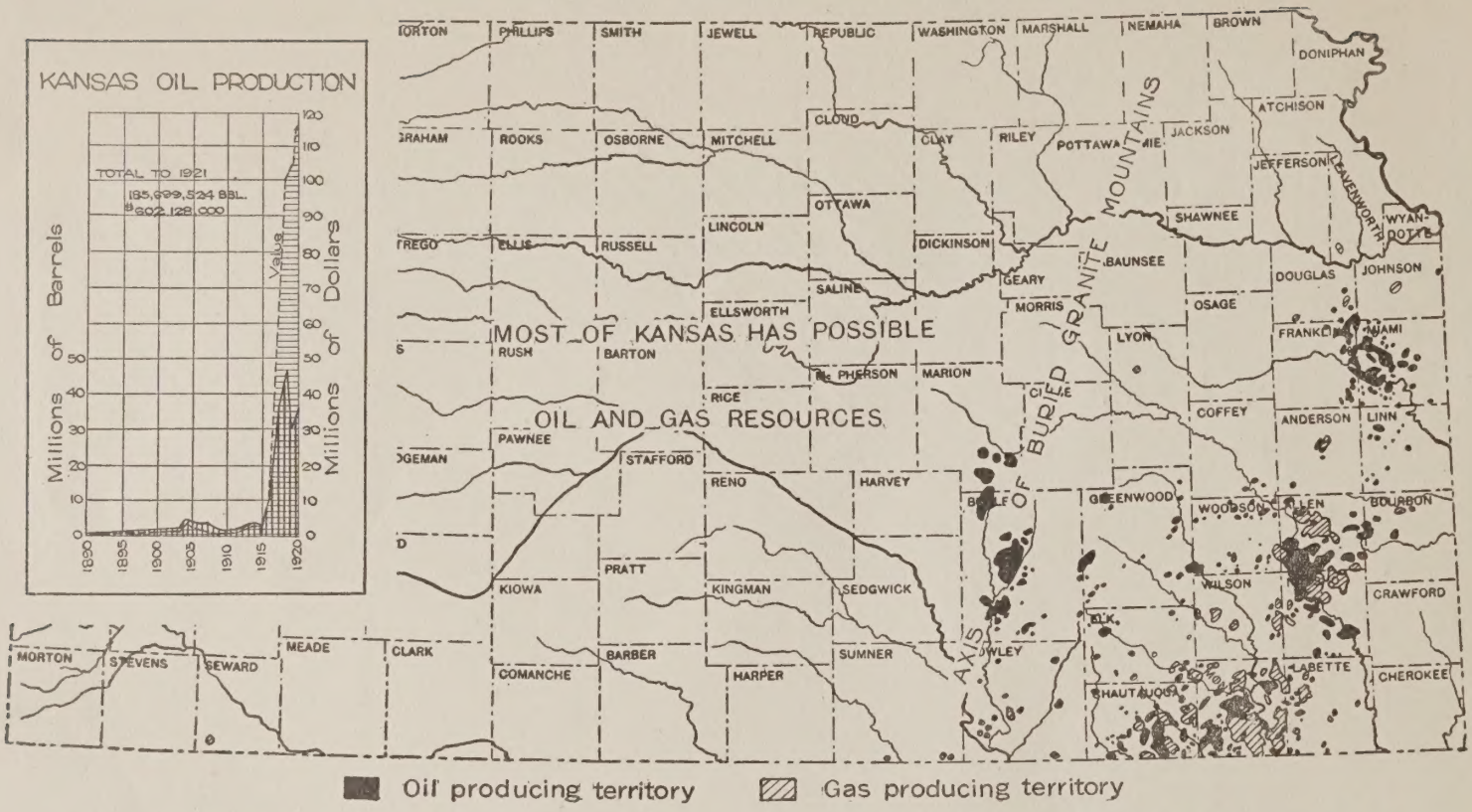
A circle indicates important commercial possibilities or operating plants.

STATE GEOLOGICAL SURVE

GEOLOGICAL MAP OF KANSAS

THE surface rocks of Kansas belong essentially to five main geological divisions, the Mississippian, Pennsylvanian, Permian, Cretaceous, and Tertiary, as shown in this map. ¶The first, exposed in extreme southeastern Kansas, contains world famous lead and zinc deposits, and it has recently been shown to contain great quantities of oil beneath Kansas. ¶The Pennsylvanian contains the coal of southeastern Kansas and most of the known oil and gas deposits of the State. Excellent cement is made from its limestone and shales, brick from its clays, and it affords an inexhaustible supply of road materials. ¶The Permian also has brick, cement, and road materials, but its chief mineral resources are salt, and gypsum. Although Butler and Marion counties lie within the outcrop area of Permian rocks, the oil in these fields is obtained from the underlying Pennsylvanian and Mississippian divisions. ¶In the Cretaceous area thick brown sandstone and light colored chalk are characteristic rocks. Here have been found deposits of very high grade clays, inexhaustible supplies of artesian water, and beds of brown coal and lignite. ¶The Tertiary consists of sand gravel, and clay, which in places are consolidated to form a hard "mortar bed." Sheet water in the Tertiary gravels is the most important underground resource in western Kansas. ¶The geology of Kansas is described in detail in Bulletin 6, Part II, which has been issued by the Survey.

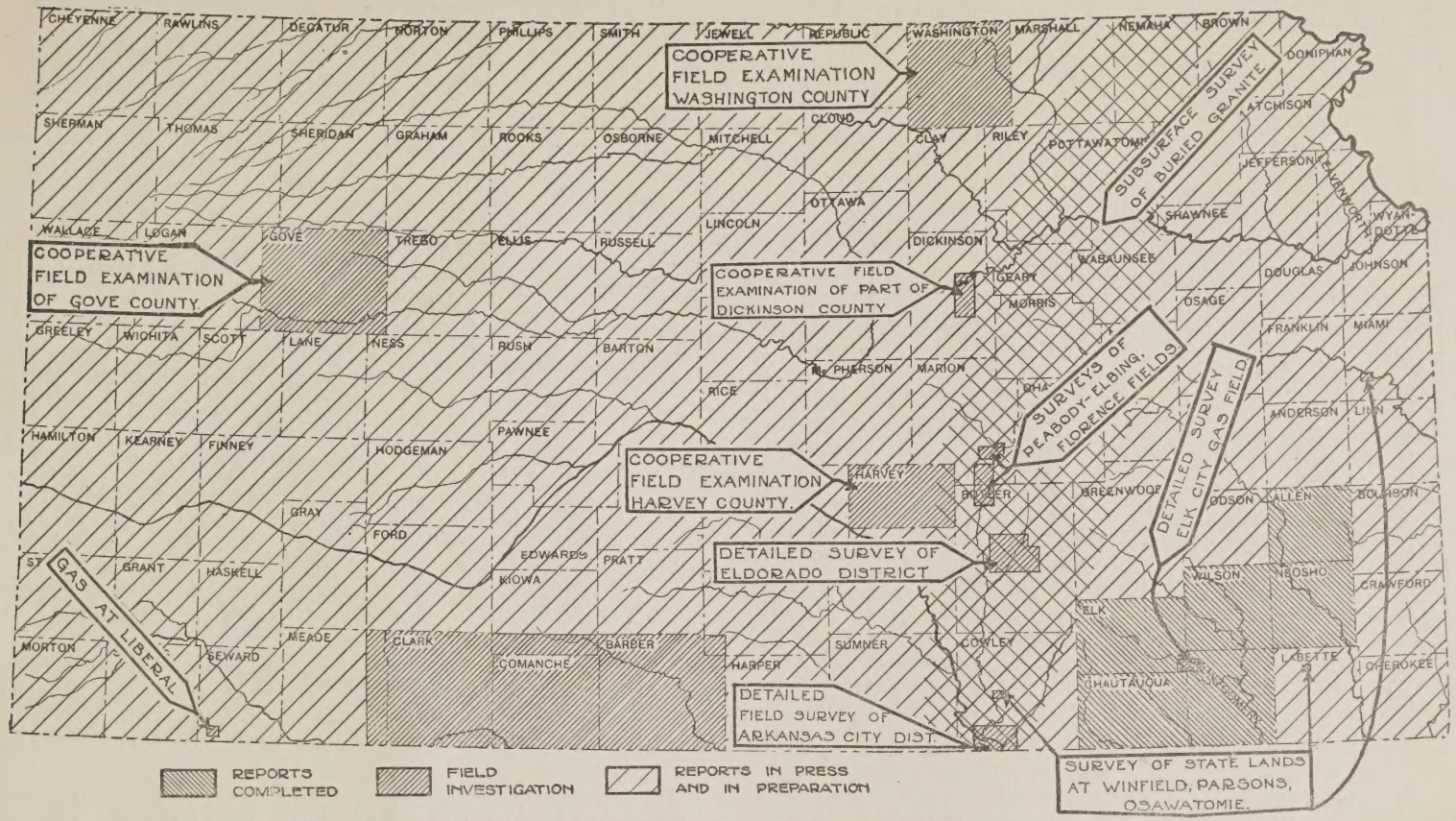
PETROLEUM AND NATURAL GAS



KANSAS entered the oil and gas business in 1860. Production reached the apparently large total of 4 million barrels in 1904, but the production of the last five years is several times greater than that of the entire first fifty years put together. ¶Two main producing areas have been developed. The first and geographically the larger, occupies the belt extending from Chautauqua and Montgomery counties northeastward toward Kansas City. This is the shallow field territory in which the wells range in average depth from 300 to 1500 feet. However, the discovery of production at greater depths in part of the shallow field indicates that there will be much deep drilling.

¶The second producing district includes Butler and Marion counties chiefly. Here the depth to the main oil zone is considerably greater than in the shallow fields. ¶It has been found that there is a prominent buried ridge or range of granite mountains beneath Butler and Marion counties, and extending clear across the State. Over this the rock strata are flexed in a very elongate anticline. The oil occurs mainly in rocks just above and on the flanks of the ridge. Conditions along the ridge and throughout the State are described in a bulletin now being issude by the Kansas Geological Survey.

THE KANSAS GEOLOGICAL SURVEY


COOPERATIVE FIELD EXAMINATION WASHINGTON COUNTY
COOPERATIVE FIELD EXAMINATION OF GOVE COUNTY.
COOPERATIVE FIELD EXAMINATION OF PART OF DICKINSON COUNTY
COOPERATIVE FIELD EXAMINATION HARVEY COUNTY.
DETAILED SURVEY OF ELDORADO DISTRICT
GAS AT LIBERAL
DETAILED FIELD SURVEY OF ARKANSAS CITY DIST.
SUBSURFACE SURVEY OF BURIED GRANITE
SURVEYS OF PEABODY-ELBING, FLORENCE FIELDS
DETAILED SURVEY ELK CITY GAS FIELD
SURVEY OF STATE LANDS AT WINFIELD, PARSONS, OSAWATOMIE.
REPORTS COMPLETED
FIELD INVESTIGATION
REPORTS IN PRESS AND IN PREPARATION

INVESTIGATIONS OF OIL AND GAS DIVISION—REPORTS PUBLISHED AND IN PREPARATION

Issued:

Bulletin 3, Oil and Gas Resources of Kansas, by Raymond C. Moore, and Winthrop P. Haynes, 391 pages, 1918, *out of print*.

Bulletin 5, The Elk City Gas Field, by C. W. Boughton, 31 pp. 1920

Bulletin 6, Oil and Gas Resources of Kansas, by Raymond C. Moore, published in parts, 1920-1921.

Bull. 6, Pt. I, General Geology of Oil and Gas, 83 pages, 1920.

Bull. 6, Pt. II, Geology of Kansas, 98 pages, 1920.

Bull. 6, Pt. V, Oil and Gas Resources of Allen and Neosho Counties, 22 pages, 1920.

Bull. 6, Pt. VI, Oil and Gas Resources of Wilson and Montgomery Counties, 32 pages, 1921.

In press:

Bull. 6, Pt. VII, Oil and Gas Resources of Elk and Chautauqua Counties, 1921. ¶Bulletin 7, Geology of the Eldorado Field, about 271 pages(numerous plates and maps. (In cooperation with the U. S. Geological Survey).

In preparation:

Bull. 6, Pt. III, The Oil and Gas Industry of Kansas.

Bull. 6, Pt. IV, Relation of Buried Crystalline Rocks in Kansas to Oil and Gas Production.

Bull. 6, Pt. VIII, Oil and Gas Resources of Labette, Cherokee, Crawford, Bourbon, Anderson, Linn, Franklin and Miami Counties.

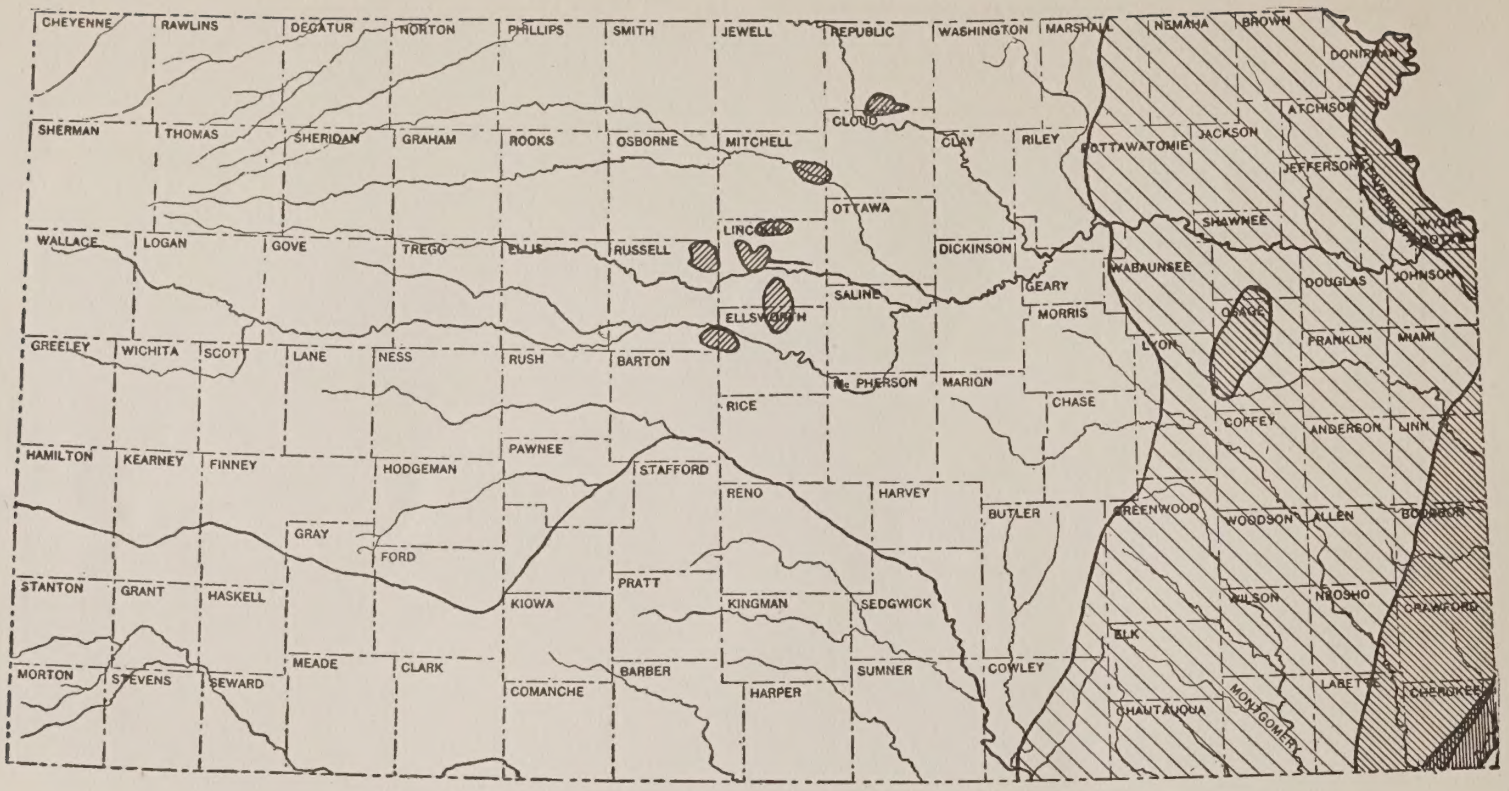
Bull. 6, Pt. IX, Oil and Gas Resources of Northwestern Kan.

Bull. 6, Pt. X, Oil and Gas Resources of Butler County.

Bull. 6, Pt. XI, Oil and Gas Resources of Central Kansas.

Bull. 6, Pt. XII, Oil and Gas Resources of Western Kansas.

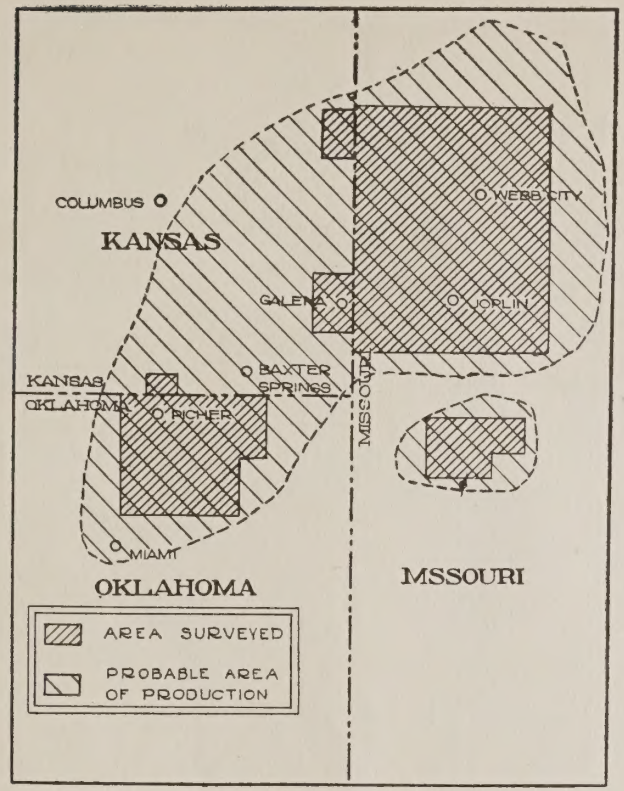
COAL, LEAD AND ZINC



BITUMINOUS COAL (WORKABLE) BITUMINOUS COAL BROWN COAL (LIGNITE) LEAD & ZINC

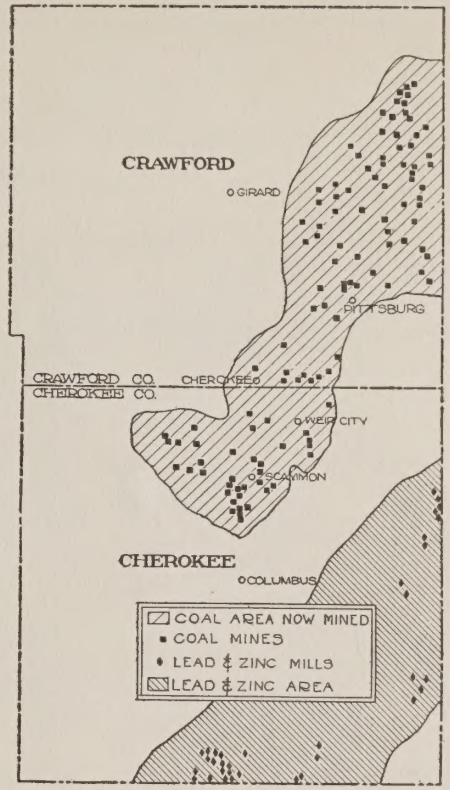
IN terms of total value the coal production of Kansas is second only to that of petroleum. The chief deposits are located in Cherokee and Crawford counties where there are very many mines and strip pits. The mines vary in depth from less than 100 feet to 600 or 700 feet and employ the "room and pillar" method of mining. In the strip pits, the coal is so near the surface that it is possible to strip off the thin covering, 10 to 35 feet of overlying soil and shale, and mine the coal in an open pit. The coal is of excellent quality. ¶Other important coal producing areas where mines have been operated for many years, are found in northeastern Kansas and in Osage County. The coal mine at the State Penitentiary at Lansing has supplied State institutions for more than four decades. Altogether, some twenty workable coals, ranging in thickness up to 5 feet, are known in Kansas. ¶Deposits of brown coal or lignite, 1 to 3 feet thick, occur in the Cretaceous in north central Kansas. This coal is high in moisture and ash and not as satisfactory as bituminous coals of the State. ¶Lead and zinc are found in Cherokee County, Kansas, and in the adjoining parts of southwestern Missouri and northeastern Oklahoma. The known mineral bearing area in this tri-State district constitutes the largest zinc producing field in the world. Very rich deposits have recently been developed in Kansas and it appears certain that the area in Kansas will become one of the most important parts of the lead and zinc district in future development. Large mines and mills are now located in the Waco-Lawton, Crestline, Badger-Peacock, and Baxter-Treece districts, Cherokee County, Kansas.

THE KANSAS GEOLOGICAL SURVEY



GEOLOGICAL SURVEY MAPPING IN LEAD AND ZINC DISTRICT

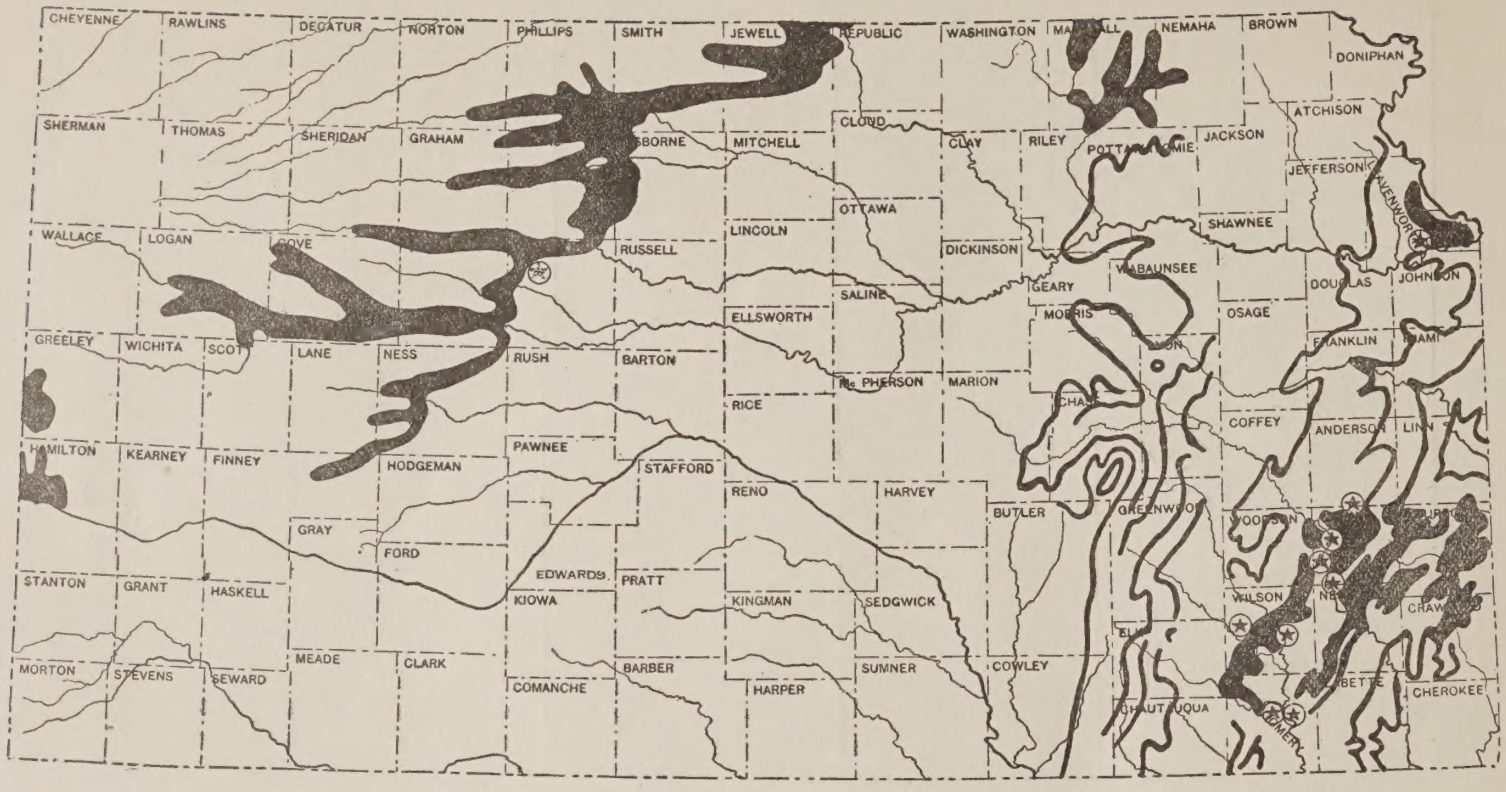
The areas in Missouri and Oklahoma have been mapped by the Geological Survey of those states.



COAL, LEAD AND ZINC MINES IN CHEROKEE AND CRAWFORD COUNTIES

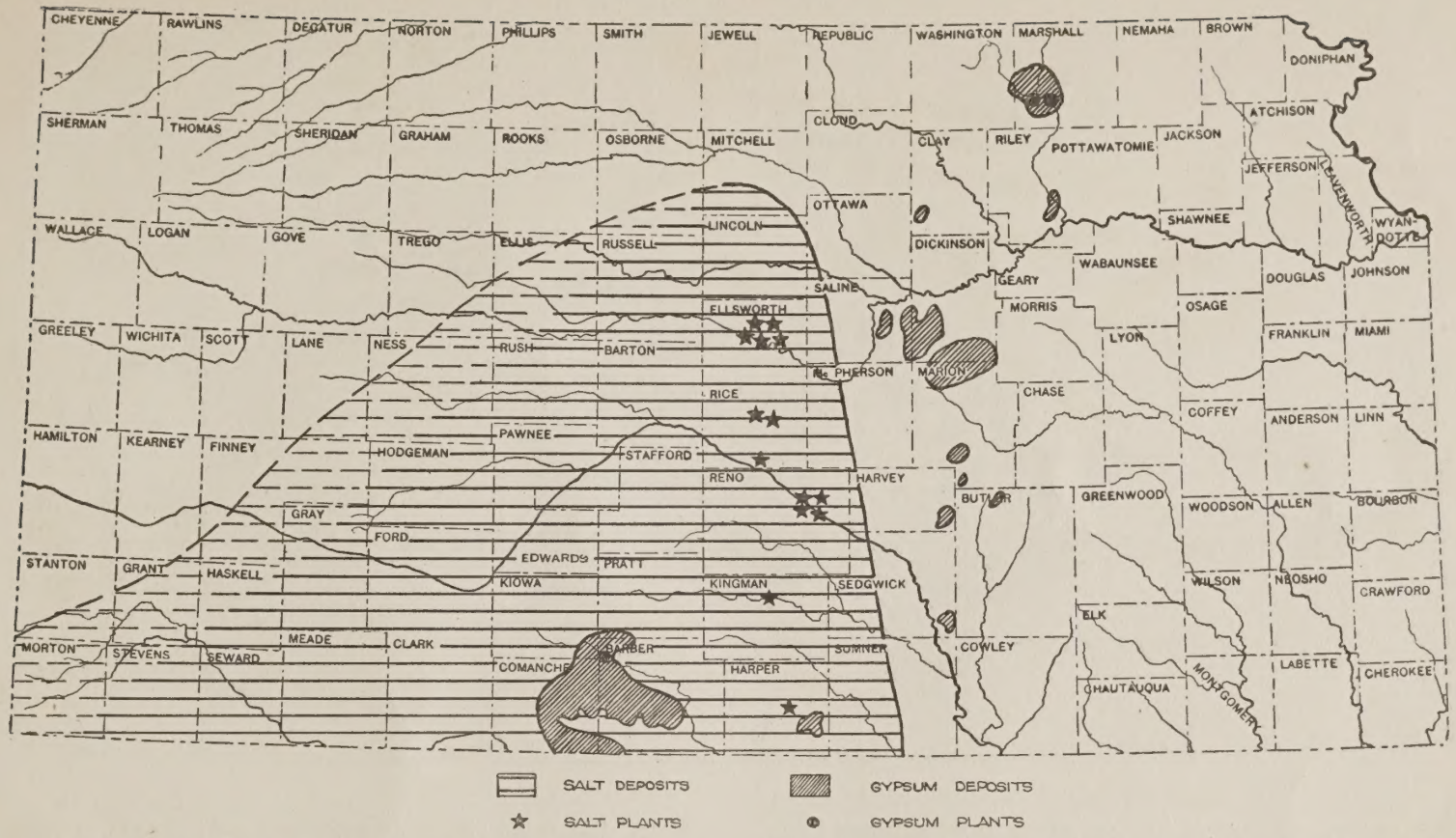
IN cooperation with the county commissioners of Cherokee County, and with the very cordial support of operators and citizens, the Kansas Geological Survey has initiated a detailed investigation of the lead and zinc district of southeast Kansas. An experienced and able topographic engineer from the U. S. Geological Survey has been engaged under arrangements with Missouri and Oklahoma which permit work, part time in each of the three States in proportion to funds available in each. Much of this mapping has been completed in Missouri and Oklahoma, but Kansas has not finished the important lead and zinc territory which should be mapped. ¶However, much proress has been made in Kansas in the geological investigation of possible developments within the State. Mr. A. C. Terrill, mining geologist, former head of the Department of Mining Engineering at the University of Kansas, has been for nearly two years resident in the district and has aided materially by his studies further development of lead and zinc in Kansas. The present annual value of Kansas lead and zinc production is about $4,500,000 but will probably be much larger as new areas in Cherokee County fields are developed. ¶Maps of the Waco-Lawton and Blue Mound areas are available for distribution. A new survey of the Galena district is nearly completed and a preliminary report on the lead and zinc deposits of Kansas is in preparation.

CEMENT



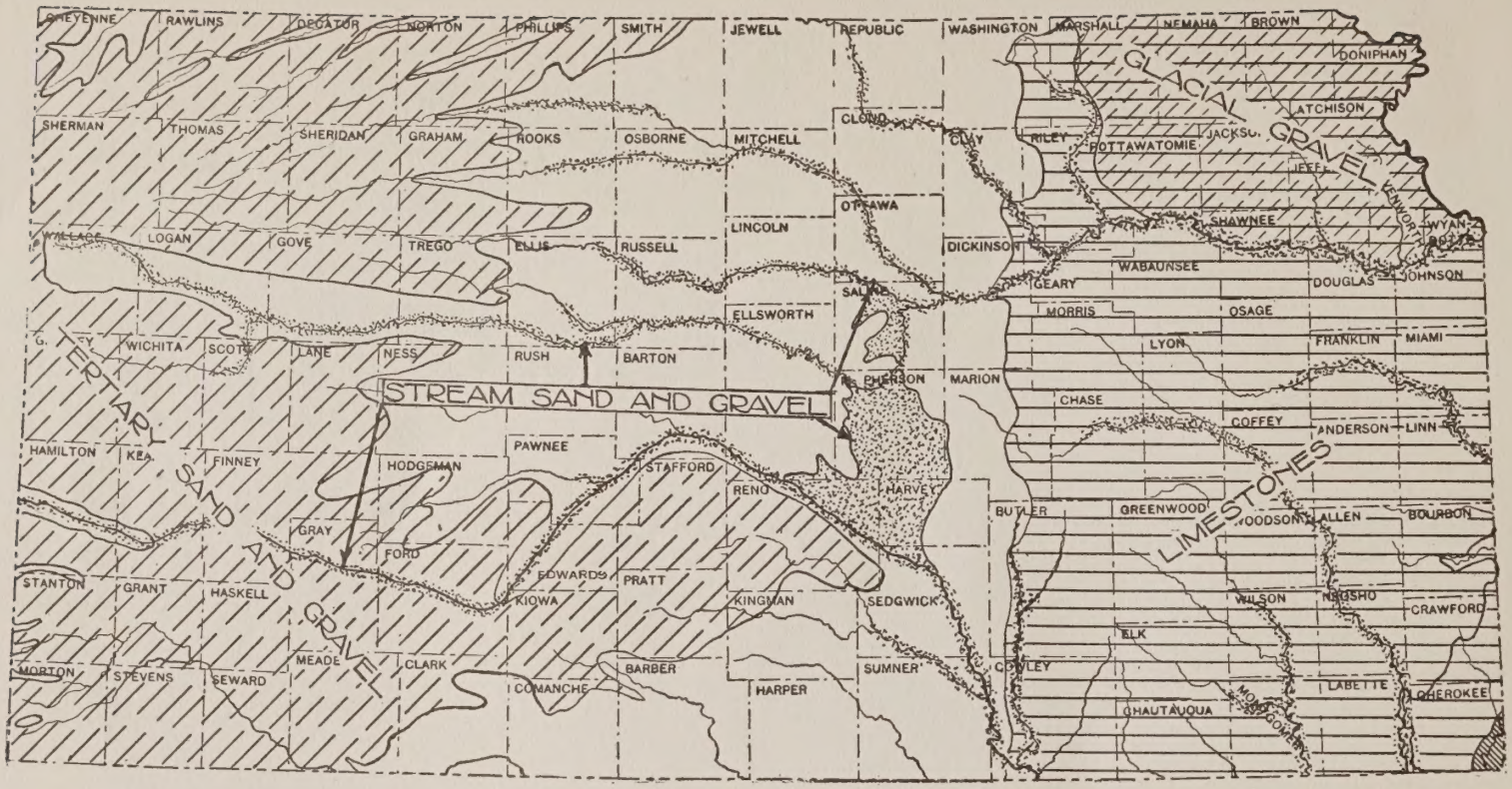
CEMENT is one of the important mineral resources of Kansas, only exceeded in value of total annual production by oil, coal and gas. Not only in road building but in the increasing amount of construction work which will be carried on, cement is one of the most valuable structural materials. The supply of cement materials in Kansas is inexhaustible. With an abundance of fuel and ready means of transportation it should be possible at very reasonable cost to supply all parts of the State. ¶The Kansas Geological Survey has not yet made a special survey of cement materials but at the request of State officials has made an examination of the possiblity of making cement from materials on the State lands at Lansing. The limestone and shale are the same strata now being used for manufacture of cement at Bonner Springs, and there is an unlimited supply of materials here with which the State might make its own cement for construction work in buildings and for hard surfaced roads.

SALT AND GYPSUM



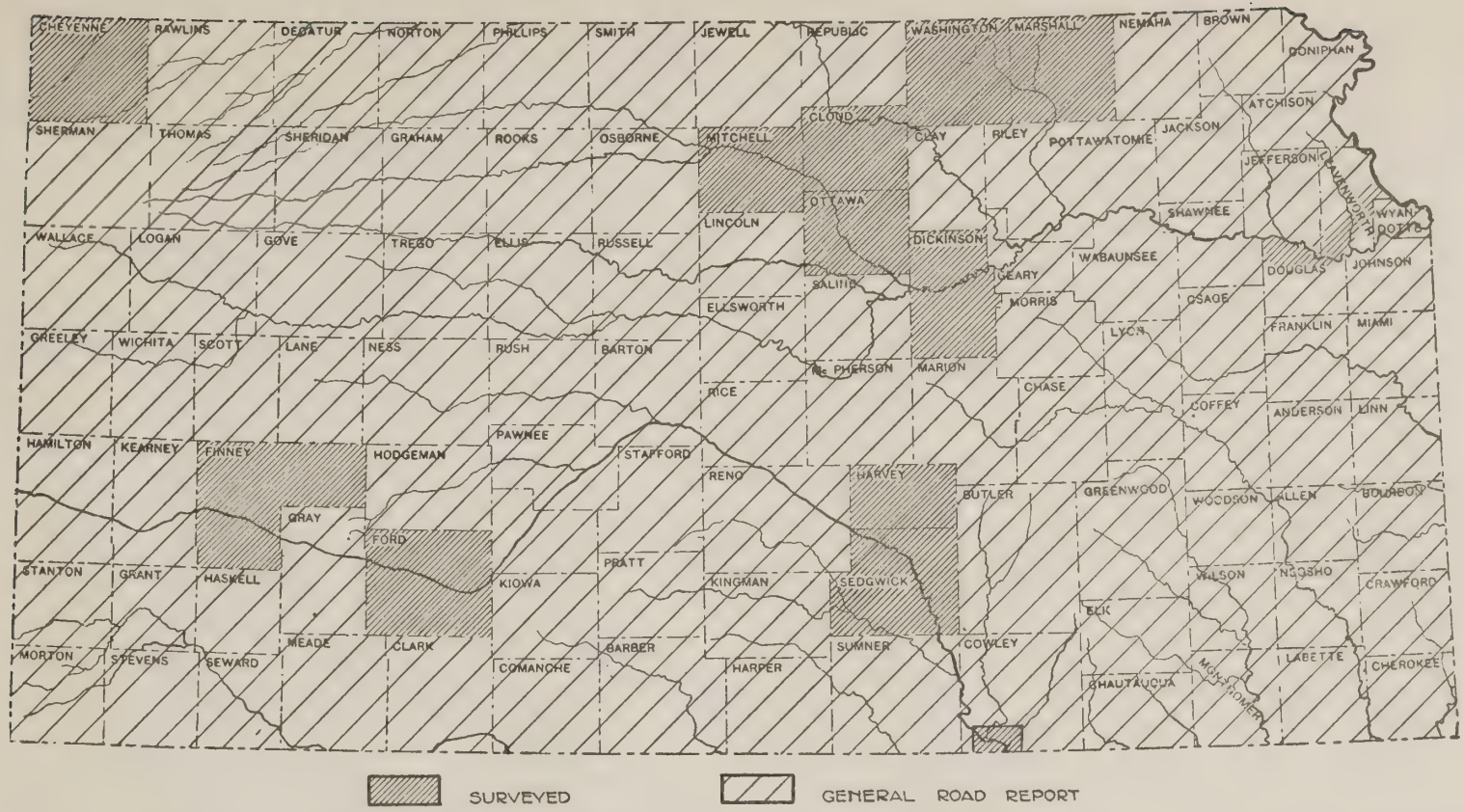
KANSAS ranks fourth among the States of the Union in production of salt, the value of the annual production now amounting to more than four million dollars. The salt, which occurs in beds having a total thickness of 400 feet in some parts of the State, is obtained both by mining and from brine wells. The area of the salt deposits and the location of salt plants, one of which is reported to be the largest in the United States, are shown on the map. Information gathered by the Kansas Geological Survey shows that the salt deposits underlie a much larger area than was first known and a considerable portion of southwestern Kansas is thus shown to have resources of salt. The supply is inexhaustible. Not only are the deposits used for production of many types of prepared salt, but other industrial materials dependent on salt as a base are now manufactured in the State. An extensive bulletin describing the salt resources of Kansas is now in preparation. ¶Gypsum deposits are widely distributed in the Permian rocks of Kansas. Inexhaustible supplies are found in Comanche and Barber counties and commercial gypsum is manufactured here and in Marshall County. The gypsum deposits of Kansas are described in Volume 5 of the Survey reports.

ROAD MATERIALS



ROAD materials of varying quality are found in almost all parts of Kansas. In the east are many beds of hard limestone, many of them available for base course in concrete road construction or various types of macadam roads. There are fewer beds which are sufficiently hard and tough for use in the upper course of concrete roads. Sand and gravel, available either for use in making concrete roads or for various types of gravel and sand-clay roads, are widely distributed. Clays for the manufacture of paving brick are present in Kansas. ¶Since the largest element in the cost of road-building and the most important element in the permanency of the road is the road material, it is very important in the building of good roads that the *right* materials be used and that they be secured from the nearest available source. In localities where one kind of road material is found but where another is lacking and therefore very expensive, it may be best to construct a different type of road than would be done otherwise. ¶The function of the Kansas Geological Survey in conjunction with the road materials testing laboratory, is to determine in each part of the State the kind of road materials present, their quality and quantity. The Highway Commission and those charged with the construction of the State's roads will thus have accurate information on which to base plans and, as in other States, it may be possible to save many millions of dollars in the final cost of road making in the State.

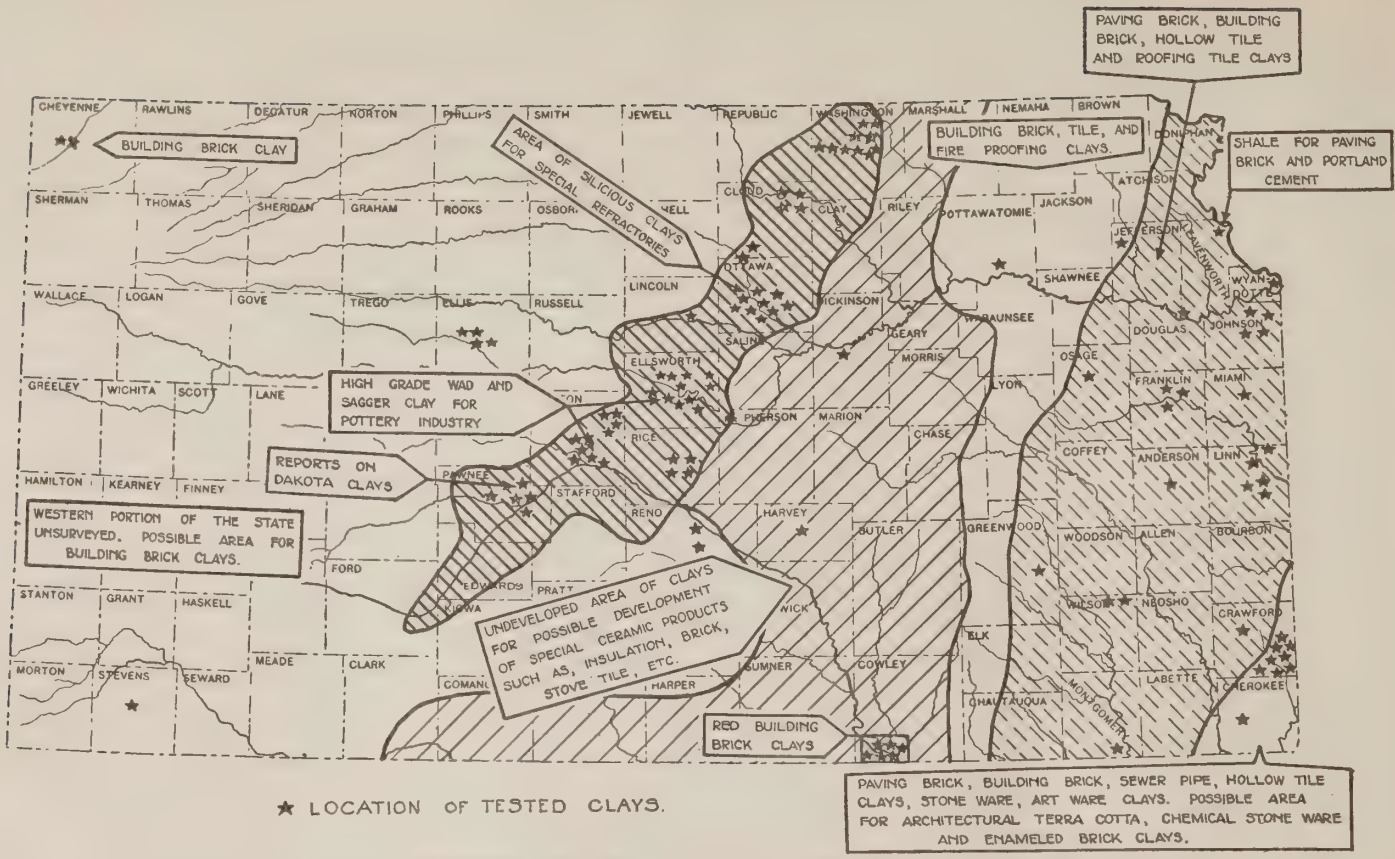
THE KANSAS GEOLOGICAL SURVEY



INVESTIGATIONS OF ROAD MATERIALS DIVISION

IN cooperation with the State Highway Commission, the State Road Materials Testing Laboratory at Manhattan and the officials of various counties, the Kansas Geological Survey has begun the detailed investigation of the quality and quantity of materials for road construction in Kansas. ¶A bulletin describing in detail the road materials in the counties where investigations have been conducted up to the present time and giving all the additional information which has been obtained for the State as a whole, is now being prepared.

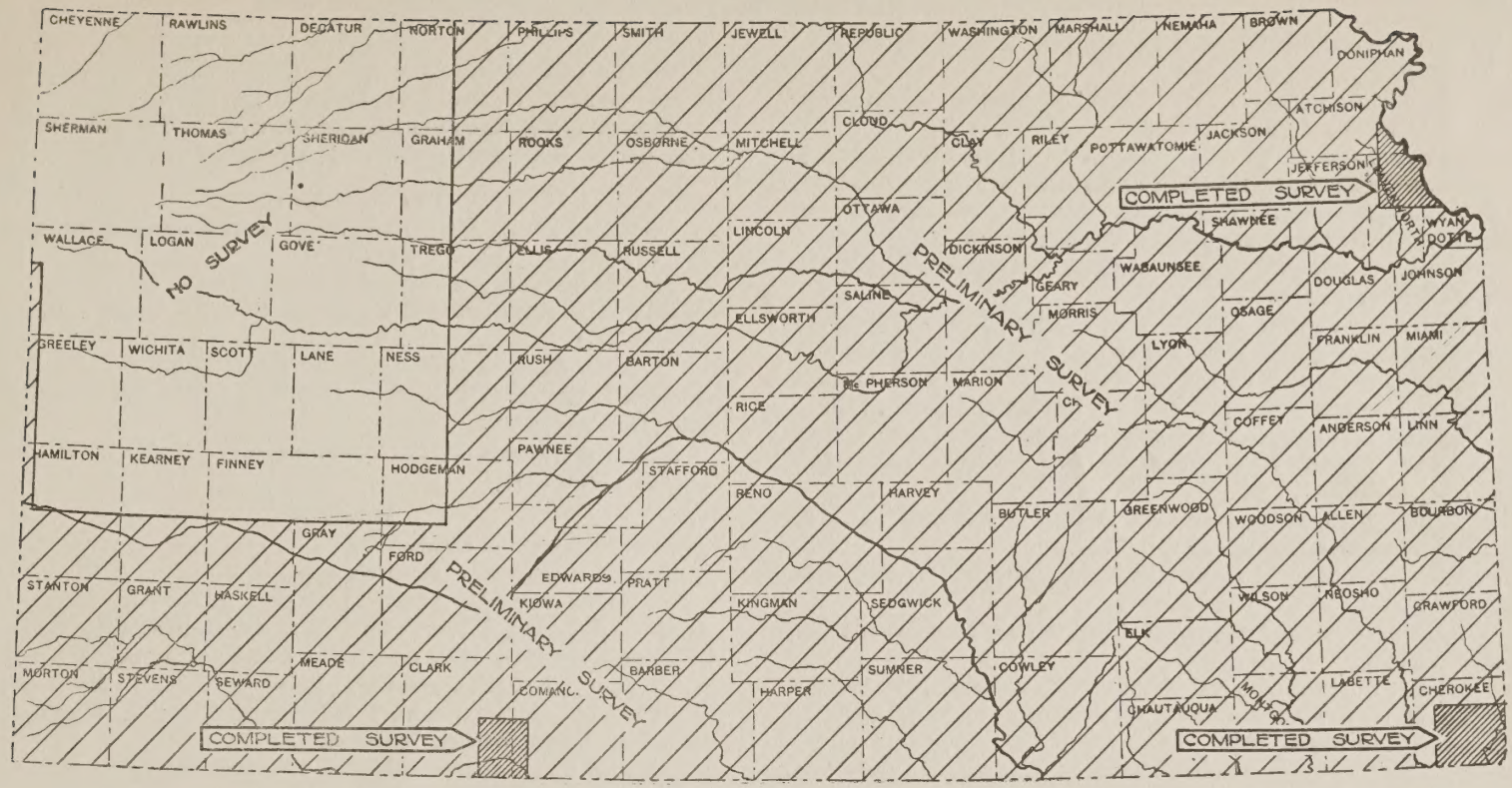
CLAYS



INVESTIGATIONS OF CLAY DIVISION

ANOTHER important and inexhaustible mineral resource of Kansas is its clay. Though less spectacular than great deposits of petroleum or metal, clay is no less useful in modern industry. The clays of eastern and central Kansas are now used at a number of places in the manufacture of building brick, tile, and paving brick. ¶The Kansas Geological Survey now has available a very well equipped testing laboratory for the investigation of the clay resources of the State. It is available for the study and testing of the clay resources of any county or city in the State and has conducted many investigations at the request of various parts of Kansas. By assistance to operators of Kansas plants it aims also to aid in the development of the Kansas clay industry. ¶Investigations of clays in the north central part of the State have shown the existence of excellent deposits of undeveloped clays of great value in pottery manufacture. A report on these clays is in preparation. Clays in eastern Kansas suitable for the manufacture of paving brick have been tested and a report on them is being prepared. Detailed tests of clay on State lands at Lansing, conducted by the Kansas Geological Survey, show that very good paving brick may be manufactured here.

TOPOGRAPHY



PROGRESS OF TOPOGRAPHIC SURVEY

THE topographic map of the United States which constitutes the only final and satisfactory map of the country, showing in addition to the usual features of maps the character, elevation, and configuration of the land, is being prepared by the Federal Government in cooperation with the States. These maps are essential for almost all kinds of engineering work, in railroad and road construction, drainage projects, underground water surveys and as a base for the final geological maps of Kansas. ¶Some of the eastern States, on account of appropriations by the State governments, have completed their maps. In Kansas, though much preliminary mapping has been completed, the final map has hardly been commenced. Since the map is specially necessary at this time, and since the funds for this mapping from the Federal government are now expended in the States which cooperate in the work, Kansas should provide for the gradual completion of its topographic map. The preliminary work which has been done will enable ready completion of the map and is of great value to the State.

THE KANSAS GEOLOGICAL SURVEY

REPORTS AND MAPS

FIRST Annual Report on the Geology of Kansas for 1864, B. F. Mudge, 56 pages, 1866.†

Preliminary Report on the Geological Survey of Kansas, G. C. Swallow, 122 pages, 1866.†

Volume 1.—Reconnaissance Report on General Stratigraphy of Eastern Kansas, E. Haworth and others, 319 pages, 1896.†

Volume 2.—General Geology of Western Kansas, C. S. Prosser, W. N. Logan and others, 318 pages, 1897.†

Volume 3.—Special Report on Coal, E. Haworth and W. R. Crane, 347 pages, 1898.†

Volume 4—Paleontology of the Cretaceous, S. W. Williston and W. N. Logan, 594 pages, 1898.†

Volume 5.—Special Report on Gypsum and Gypsum Cement Plasters, G. P. Grimsley and E. H. S. Bailey, 184 pages, 1899.

Volume 6—Paleontology—Carboniferous Invertebrates and Cretaceous Fishes, J. W. Beede, S. W. Williston and Alban Stewart, 516 pages, 1900.

Volume 7—Special Report on Mineral Waters, E. H. S. Bailey, 343 pages, 1902.

Volume 8.—Special Report on Lead and Zinc, W. R. Crane and A. F. Rogers, 543 pages, 1904.

Volume 9.—Special Report on Oil and Gas, E. Haworth, 586 pages, 1908.†

Annual Reports, Mineral Resources of Kansas, 1897-1903.†

Bulletin 1.—Special Report on Well Waters in Kansas, E. Haworth, 110 pages, 1913.

Bulletin 2.—On Crystalline Rocks in Kansas, E. Haworth, 33 pages, 1915.†

Bulletin 3.—Oil and Gas Resources of Kansas, R. C. Moore and W. P. Haynes, 391 pages, 1918.†

Bulletin 4.—The Environment of Camp Funston, R. C. Moore, 81 pages, 1918.

Bulletin 5—Elk City Gas Field, C. W. Boughton, 31 pages, 1920.

Bulletin 6.—Part 1.—General Geology of Oil and Gas, R. C. Moore, 83 pages, 1920.

Bulletin 6, Part II.—Geology of Kansas, R. C. Moore, 98 pages, 1920.

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Bulletin 6, Part VI—Oil and Gas Resources of Wilson and Montgomery Counties, R. C. Moore and C. W. Boughton, 32 pages, 1921. † Out of print.

In Press

Oil and Gas Resources of Elk and Chautauqua Counties, R. C. Moore and C. W. Boughton, about 30 pp. (Bull. 6, Part VII).

Geology of the Eldorado District, A. E. Fath (in cooperation with the U. S. Geological Survey), about 200 pp., (Bull. 7.)

In Preparation

Relation of Buried Crystalline Rocks in Kansas to Oil and Gas Production. (Bull. 6, Part III).

The Oil and Gas Industry of Kansas, (Bull. 6, Part IV).

Oil and Gas Resources of Kansas by Counties (Bull. 6, Parts VIII to XII).

The Clay Resources of Kansas, P. Teetor (Bull. 8).

Road Materials of Kansas, in cooperation with State Testing Laboratory, (Bull. 9).

Economic Geology of the Arkansas City District, E. R. Elledge (Bull. 10).

MAPS

Geological map of Kansas.

Geological map of eastern Kansas.

Geological maps of counties: Allen, Anderson, Barber*, Bourbon, Cherokee, Clark*, Cloud*, Coffey, Comanche*, Cowley, Dickinson, Douglas, Elk, Gove, Greenwood, Labette, Leavenworth, Linn, Lyon, Marshall*, Meade*, Miami, Mitchell*, Montgomery, Osage, Ottawa*, Sedgwick*, Shawnee, Washington*, Wabaunsee, Wilson, Woodson.

Oil and Gas maps—Production counties: Anderson, Chautauqua, Coffey, Cowley, Butler, Dickinson, Douglas, Elk, Franklin, Greenwood, Johnson, Labette, Leavenworth, Linn Lyon, Miami, Montgomery, Osage, Wilson, Woodson. *Production, fields*: Augusta field, Eldorado field. *Structure*: Arkansas City area, Butler County, western, subsurface contour map of buried granite, Elk City gas field (Montgomery and Elk counties), Florence field, Greenwood County (western), Peabody-Elbing field.

Base maps (Road materials series, scale 1 inch to 1 mile), counties: Cheyenne*, Cloud*, Dickinson, Finney*, Ford, Harvey, Mitchell*, Sedgwick*, Washington*.

Lead and zinc maps: Blue Mound district topography, etc.; Galena district, topography, etc.; Treece district, underground workings*; Waco-Lawton district, topography, etc.; Township 34 S., R. 24 E., topography, etc.*; Numerous geological sections*. * *In preparation.*

THE KANSAS GEOLOGICAL SURVEY

THE NATURAL RESOURCES DEPARTMENT OF THE STATE

THE Kansas Geological Survey is the official department of the State for gathering of information concerning the mineral resources and geology of Kansas and for the distribution of authentic facts which will advance knowledge of them and aid in their development. The character and application of its research are of great variety and of utmost importance to the State. ¶It tests an unnoticed clay of central Kansas and finds a material suitable for use in high grade pottery manufacture. ¶It examines the underground conditions in a Butler County oil field and finds where and how the oil occurs so that larger roduction may be obtained here and that drilling in other areas may be guided. ¶It discovers the controlling geologic conditions which have produced the great oil fields of central Kansas and, gathering information from each drilling test, indicates for the benefit of operators and the public, facts which have been learned and their application in the search for more oil and gas. ¶It examines all materials in the vicinity of a road building project to ascertain what quality and quantity of local stone, sand and gravel may be available, thereby contributing largely to saving in costs of construction. ¶It makes a detailed survey of producing and prospective lead and zinc territory, gathers records of drill tests, and indicates the probability of undeveloped ore deposits. ¶It prepares maps showing the character of the topography, surface rocks, underground mineral resources, water supplies, etc. ¶It supplies to other State departments reliable data for use in taxation, prevention of fresh water pollution, appraisal of oil properties for incorporations of companies and for permission to sell stocks in the State, and in developing wisely and conserving the State mineral wealth. ¶It investigates the possibility of finding natural gas on State lands for the purpose of fuel in State institutions, finds favorable structure and recommends a test by drilling. Gas is found. ¶It tests clay and limestone deposits on State lands at Lansing and finds materials suitable for the manufacture of paving brick and cement, materials needed by the State in construction of good roads and building. ¶The Federal Government and almost every State, maintain efficient Geological Surveys. In some States the mineral resources are relatively small. Kansas, although commonly regarded as a farming State, is one of the States with very important mineral resources. It is not only desirable but necessary to have in Kansas a "Natural Resources Department" fully equal to those maintained by neighboring States.

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THE KANSAS GEOLOGICAL SURVEY